

HANDOUT **3** Agricultural Biomass

Agricultural biomass is a relatively broad category of biomass that includes: the food-based portion of crops (such as corn, sugarcane, and beets), the nonfood-based portion of crops (such as corn stover [the leaves, stalks, and cobs], orchard trimmings, and rice husks), perennial grasses, and animal waste. Traditionally, there have been high costs associated with recovering most agricultural residues, and therefore, they have not yet been widely used for energy purposes. However, they can offer a sizeable biomass resource if technology and infrastructure are developed to economically recover and deliver this type of biomass to processing facilities.

Food-based Portion of Crops (oil and simple carbohydrates)

The food-based portion of crops is the part of the plant that is either oil or simple sugars. Rapeseed, sunflower, soybeans, corn, sugarcane, and sugar beets are all examples of this type of agricultural biomass. The sugar from corn, sugar beets, and sugar cane are commonly fermented to produce ethanol. Oilseed crops such as rapeseed, sunflower, and soybeans can be refined into biodiesel.

Nonfood Based Portion of Crops (complex carbohydrates)

The nonfood based portion of crops is the part of the plant that is commonly discarded during processing for food production. This category includes materials such as corn stover; wheat, barley, and oat straw; and nutshells. Stover and straw are fermented into ethanol. Nutshells are typically refined into biodiesel or combusted for heat. Due to the important function of crop residues in erosion protection and overall soil quality, care must be taken on a site-by-site basis to ensure sustainability.

Figure 1: Corn is one example of the food-based portion of a crop. It is primarily fermented into ethanol. PHOTO COURTESY OF WARREN GRETZ, NATIONAL RENEWABLE ENERGY LABORATORY.



Figure 2: The nonfood based portion of crops is commonly discarded but can be used to make bioproducts. PHOTO COURTESY OF WARREN GRETZ, NATIONAL RENEWABLE ENERGY LABORATORY.



Perennial Grasses

Perennial grasses are grasses that have a life cycle of several years. Some examples include big bluestem and switchgrass. The advantage of perennial grasses is that they have a low nutrient demand, a large geographical growing range, and high net energy yields (Downing et al., 1995). Perennial grasses are pre-treated to break down cellulose and then fermented into biofuels such as cellulosic ethanol.

Figure 3: *Switchgrass*. PHOTO COURTESY OF ART WISELOGEL, NATIONAL RENEWABLE ENERGY LABORATORY.



Animal Waste

Beef cattle, dairy cattle, hogs and poultry produce manure, which can be used to produce energy. Manure is typically categorized as a liquid, slurry (a mix of liquid and solids), or solid. In its solid state, manure can be burned for heating and cooking or to produce a gas for energy production. As a slurry, manure releases methane (CH₄), which can be captured to produce heat, power, electricity, and biofuels.

Figure 4: *Feedlot operations result in large quantities of manure which can then be used to produce energy.* PHOTO COURTESY OF BRIAN PRECHTEL, AGRICULTURAL RESEARCH SERVICE.



References

Downing, M., M. Walsh, and S. McLaughlin. 1995. Perennial grasses for energy and conservation: Evaluating some ecological, agricultural, and economic issues. Environmental Enhancement through Agriculture: Proceedings of a Conference, Boston Massachusetts, November 15-17. Center for Agriculture, Food and Environment, Tufts University, Medford, MA.

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